

NERVO-VASCULAR DISTURBANCES IN UNACCLIMATED PERSONS IN COLORADO.

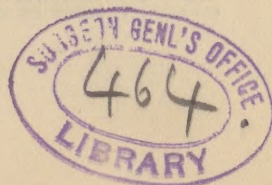
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DENVER, COLORADO.

NERVOUS and vascular disturbances are the most prominent symptoms manifested by persons unpleasantly affected by high altitudes, but these are not the only symptoms, and are probably never the primary ones. Theoretically and practically, the lungs are the first to feel the effects of high altitudes, but unless the altitude be very great, the lungs very susceptible to changes in the density of the air, or the person indiscreet enough to take too much exercise on first going to high altitudes, he may let pass entirely unnoticed the slight disturbances in his breathing. Man in his normal condition easily adapts himself to any climate or altitude. He is almost the only animal who can live and thrive in the torrid zone with a temperature of 110° to 120° F., or in a frigid zone with a temperature from 60° to 80° below zero. He lives, works, and thrives thousands of feet below the earth's surface, or on the highest mountains, miles above sea-level, but to perform these feats a process of acclimatization is necessary.

A study of the effects of extremely high altitudes on the unacclimated is exceedingly interesting. In 1887, I reported a case of temporary amnesia and confusion of consciousness in a person who ascended to the top of Pike's Peak (elevation over 14,000 feet) on horseback. (See *Journal of Nervous and Mental Disease*, October, 1887.) Last year (1890) I reported to this association an additional case in which the legs were temporarily paralyzed in a man whilst crossing in a wagon one of the highest passes in the neighborhood of Leadville (elevation of the pass about 11,000 feet). I can now add a third case in the person of a tourist (male), who

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ascended Pike's Peak during the present year on the cog-wheel railroad. The case was related to me by Dr. Chapin, of Philadelphia, who made the ascent of the peak on the same train with the gentleman in question. When he reached the peak he felt perfectly comfortable, but on attempting to rise to his feet he found that he could not move his legs.

In the present paper I shall only make this brief reference to the effects of extremely high altitudes on the unacclimated. I desire to discuss the effects of the altitudes of the usual resorts for invalids who seek Colorado for purposes of health. My remarks will not be limited to the invalid class, for I shall have something to say of the effects of altitude upon unacclimated persons advanced in life.

An interesting paper might be written on the effects of a prolonged residence in Colorado upon men and women, but especially upon the latter. It is a subject which I have been carefully studying for seven years, but, as the results of my observations differ widely from the views of some of the oldest and best-known physicians in Colorado, I desire still further to pursue my observations and studies in this direction, lest I have arrived at conclusions which are at variance with facts.

In speaking of the influence of the climate of Colorado on the nervous and vascular systems of the unacclimated, I desire to be understood as referring to those who, on first visiting Colorado, take more or less active exercise, or live as actively as they had done at sea-level. By proper precautions the unacclimated in a vast majority of cases, be he an invalid or one in the enjoyment of sound health, can gradually accommodate himself to the effects of the climate, so as to experience little or no unpleasant effects in the process of acclimatization. Of this I desire to speak later.

On going into a rarefied atmosphere the work of the lungs is immediately increased. The usual "tidal air" sufficient for the demands of the tissues at sea-level becomes inadequate, and the additional volume of air must be obtained by increased frequency of the respiratory act or by a larger quantity of air being inhaled during each inspiration.

Theoretically it seems reasonable to expect that when the increased volume of air is obtained by increased frequency of respi-

ration, the pulse is more frequent than when the respirations are slower and more prolonged. I have made a number of experimental observations on healthy and invalid persons to determine this question, but as yet I have not found a spirometer suitable to my purpose. The observations which I made without an instrument to measure accurately the quantity of air inhaled at each inspiration, while they seem to point without much variation to increased frequency of the pulse under the condition above named, are yet not sufficiently accurate to be worthy of publication.

I have had several opportunities of comparing the effects of exercise on my own person in Colorado with the effects following a similar amount of exercise at sea-level. Invariably the disturbances have been greater in the former than in the latter place. This accords with the clinical experience of nearly every physician in Colorado, and needs no further comment here.

It is difficult, if not impossible, to separate the circulatory from the nervous phenomena. If we note the disturbances of the heart's action as a type of the vascular systems, we shall find that they are largely of a nervous origin, or, if we analyze many of the nervous symptoms, especially headache, vertigo, etc., we shall see that they are directly due to vascular disturbances, although the latter have their origin in irritable nerve-centres.

What part lessened atmospheric pressure plays in the production of many symptoms manifested by the unacclimated in Colorado, at altitudes varying from 5000 to 8000 feet, it is difficult to determine. That it exerts some influence is quite evident, but that the influence is almost inappreciable at an altitude of 5000 or 6000 feet in producing unpleasant symptoms seems equally evident when we remember that by proper precautions the unacclimated whose breathing capacity is fair without having the atmospheric pressure modified, becomes accustomed to the altitude, and suffers but little inconvenience in the process as long as he gives his heart and lungs as little to do as possible.

For all practical purposes, then, at altitudes varying from 5000 to 8000 feet, the inconvenience of the unacclimated seems to have its origin in the increased respiratory activity, and this in turn leads to increased work of the heart, which by its over-work causes at first an active hyperemia and an irritability of the nerve-

centres. Later the nerve-centres suffer from imperfect nutrition induced by a poor blood-supply which results from passive hyperemia. We have then the "irritable weakness" of the old pathologists. After the nerve-centres have become irritable, neither the respiratory act nor the heart's action is performed as regularly and methodically as in the normal condition; and, in consequence, various unpleasant symptoms are experienced by the unacclimated. Persons possessed of considerable vigor, and capable of adapting themselves to great changes in their environments, go to high altitudes and live almost as they had done at sea-level, and find no appreciable inconvenience in so doing; but for those advanced in years and for those of feeble health the consequences are far different.

Heart and Pulse.—I have observed the action of the heart and the condition of the pulse in a number who have experienced difficulty on going to Colorado. At first the heart's action is increased in frequency and force, and the pulse is increased in volume and tension; but soon the heart becomes irritable, its action is less effective, its beat is quite rapid, and, at times, irregular or intermittent. At this stage the pulse loses its increased tension and volume, and is usually small and weak. The superficial capillaries are commonly dilated, and if the heart be still further taxed, beginning cyanosis of the face and distal portions of the extremities renders apparent the inefficiency of the cardiac systole. Palpitation and oppression in breathing or various uncomfortable sensations over the precordium are quite common in those whose hearts have become irritable on going to Colorado. Some complain of a dyspnoëic or smothering sensation, and say that they feel as though they were unable to breathe sufficiently to relieve their distressed condition.

An over-worked heart in a high altitude probably gives rise to the most distressing and alarming symptoms in those advanced in life, and especially to those whose hearts are fatty, or weak and flabby. In two such that I have seen, the first unpleasant symptom, beyond a little shortness of breath and a slight uncomfortable feeling over the heart, was fainting, followed by cyanosis and prolonged unconsciousness with stertorous breathing. In one the unconscious condition lasted fifteen or twenty minutes, and in the

other, several hours. Both were greatly prostrated after the attack, and did not regain their strength until removed to a low altitude. They were kept quiet, in a recumbent posture, and fed and stimulated for several weeks: but they seemed to lose strength, and finally had to be removed from Colorado in a recumbent posture, as a slight elevation of the head caused cardiac distress and a fainting feeling. Both rapidly recovered their strength on reaching a low altitude, where one well advanced in years is still living. The other is now residing in Colorado at an altitude of about 5000 feet, where, with proper precautions, the altitude seems to be borne quite well.

Gastric and intestinal disorders are not infrequent in persons who suffer in the process of acclimatization. These are evidently of a twofold origin, nervous and vascular.

In two persons, soon after their reaching Colorado, and on their taking an undue amount of exercise, I have known hemorrhoids to be suddenly developed. In one case the constitutional disturbance was very severe. The patient, a lady, became hysterical, had a chill lasting an hour or more, and this was followed by a rise of temperature, reaching 106° two hours after the chill. The temperature was 100° six hours later. A severe inflammatory attack of hemorrhoids followed. In this case there was no hepatic, gastric or intestinal trouble at the time to account for the development of the hemorrhoids.

Hyperemia of the exposed mucous membranes is the ordinary experience of most persons who go to Colorado. Lessened atmospheric pressure may aid slightly in producing this, but the chief cause is the dryness of the atmosphere, except in those portions of the State in which considerable alkali is mixed with the dust. In the latter condition the hyperemia is followed by chronic inflammation and thickening of the exposed mucous surfaces. Under such conditions, acclimatization does not protect, and these changes may be classed with the chronic effects of the climate, and need not be further considered here.

Menstruation.—There is a prevalent opinion in Colorado that the climate modifies the menstrual flow in various ways, not only in the unacclimated, but also in those who have resided there a number of years. To what extent, I hope to be able to form

some estimate, when I have gathered data for a paper on the chronic effects of the climate on the nervous and vascular systems. Many ladies seem to experience but little or no effect from the climate on their menstrual function on first going to Colorado, whilst in others the periods become irregular and the flow is increased. On this point I am not satisfied, as the number I have interrogated is too limited to enable me to draw conclusions, especially in regard to a function that is so frequently perverted by causes other than climatal.

In speaking of the nervous disturbances experienced in Colorado by the unacclimated who suffer from the effects of the climate, I shall try to refer to them as nearly in the order in which they arise as possible, although it must be remembered that this can be done only for the majority, as there are always exceptional persons who suffer differently from others. It is not an easy matter to know how much to attribute to climate. By some, every nervous symptom that is felt in Colorado is attributed to the evil effects of the climate, and these same persons lay down a dogmatic rule to the effect that every nervous affection is increased by going to Colorado. Of late, as the effects of the climate are being more carefully and scientifically studied, we are learning to attribute some influence, especially on the nervous and hysterically inclined, to mental impression. Many persons who go to Colorado are fully convinced before they have been there twenty-four hours that the climate will affect them unpleasantly, and that they will be unable to live there. They believe every exaggerated statement repeated by the credulous, and soon begin to experience the sensations that they have been led to think will be caused by a dry climate in a high altitude. Further, we have learned to contrast nervous affections observed in the East with the same studied in Colorado, and some of us believe that we find but little if any difference in their course, except probably for the functional nervous disturbances which are, I think, slightly exaggerated by the climate of Colorado.

Almost every person on first going to Colorado experiences a sensation of well-being and stimulation. The mind is active, and there is a tendency to indulge in day-dreaming or castle-building, rather than in a philosophical meditation. Thought after thought,

in quick succession, rapidly flits through the mind, pleasant and entertaining for the time, but usually evanescent in character, and the aspirations and ambitious resolves, which are then formed, are short-lived, and rarely lead to permanent results.

The motorial system is not unaffected, and the desire to exercise is great. If physical exercise be indiscriminately indulged in, the person soon becomes restless. To keep quiet then is difficult and irksome, but to continue the exercise increases the nervous, restless feelings. The legs feel tired and heavy, and numb and tingling sensations, with pains in the joints, are often experienced. Sleeplessness follows, and this, combined with restlessness, makes the night almost unendurable. I wish it to be understood in this connection that I am now speaking of the unacclimated who go to Colorado and live injudiciously. For the vast majority of persons, who seek Colorado for health or recreation and live as their changed environments demand, sleep is, as I have pointed out in another communication to this Association, easily obtained, sweet, prolonged, and refreshing. Headache is a common complaint of those who experience unpleasant symptoms in the climate, and more commonly follows than precedes sleeplessness. It is sometimes of a dull, heavy character, without definite location to any part of the head; at other times, it is frontal, but more commonly it is occipital, when it is often associated with a drawing sensation in the back of head and neck, and frequently with tenderness over the cervical spines. At this time the heart is irritable and tinnitus aurium is complained of. Following this train of nervous symptoms comes depression of spirits. The sufferer gets low-spirited and has "fits of the blues." In exceedingly nervous females it is not uncommon to hear outbursts of hysterical manifestations. Some are troubled with fainting spells, dizziness, or even marked vertiginous sensations. Irritability and peevishness are common in those who have become excessively nervous on going to Colorado. Mental depression becomes so great in some as to lead to slight mental confusion. The mind may work all right for a while, but sustained mental effort is difficult and tiresome. I have not seen a case of insanity in which I have been able to attribute the cause solely to the effects of the climate. I have known a number of

cases of insanity in which the violent outbreak has developed soon after going to Colorado, but in these the climate and scenery of the State had been sought simply for the sake of change and diversion, and the subject had been kept going from place to place, excited and over-worked, and in some cases sufficient sleep had not been obtained, nor the proper amount and quantity of food taken.

Time for Acclimatization.—It is impossible to say how long a time is required for a given person to become acclimated. Many persons of vigorous health and constitution, with good lungs and a normally acting strong heart, seem to adapt themselves to their new atmospheric conditions almost immediately after reaching Colorado, and never experience any perceptible difficulty, although they indulge in active exercise and various other indiscretions regardless of possible effects. Others, less favored by nature, experience slight inconveniences on first taking active exercise, but on further persisting they cease to be troubled, and live as comfortably as they had done at sea-level.

For all persons suffering from pulmonary disease, heart affections, organic or functional, or from irritable and excitable nervous systems, the process of acclimatization is of the first importance, and seems to be but little understood, or, if understood, not heeded by the majority of physicians living at low altitudes. For each individual belonging to any or all of the three classes above mentioned, specific rules must be laid down by his physician in Colorado, and these rules can be only safely varied from time to time, as the favorable progress of the case may indicate. Time, *per se*, seems to play an insignificant part in acclimatization in these cases. It is the effect of the climate on the invalid, and not the time spent in Colorado, that enables the prudent physician to judge as to what his patient may or may not do.

Some persons never become accustomed to the climate of Colorado, and although they may spend years there, are never able to live as they were wont to do at sea-level. For such, eternal watchfulness and care are the price of health and comfort there.

How Persons Should Live During the Progress of Acclimatization in Colorado.—It is on account of the great importance of this part of my subject that I have endeavored to write on the nervo-vascular disturbances arising in the unacclimated in Colorado. For persons advanced in years, and for nearly all invalids, there is but one rule—keep comparatively quiet at first, and, when moderate exercise is begun, always stop short of the point of decided fatigue. I have not treated chest troubles since I went to Colorado, but, being a consumptive myself, I have taken a keen interest in a number who have gone there for pulmonary disease, and have tried to watch and profit by the causes that have seemed to determine their success or failure in regaining their health. Of the suitable cases of pulmonary consumption that have sought Colorado, I do not think I am exaggerating when I say that untimely and over-exercise have killed more persons than the progress of the disease. Both clinically and experimentally it is quite positively determined that a comparatively quiet life is the one most conducive to the health and welfare of the consumptive on first going to Colorado. For the consumptive there are many reasons why exercise should be limited at first, and subsequently indulged in only as is thought safe by his physician.

For persons of irritable nervous temperament, and for those suffering from weak or irritable hearts, a quiet life is by far the best on first going to Colorado. Persons, the muscular tissue of whose hearts is beginning to degenerate, should not go to Colorado or any other place with an altitude many thousand feet above sea-level. In all cases, no matter what the ailment may be for which a high altitude is sought as a health resort, it is better and safer for the patient to follow the directions of the local physicians than to try to take regular and systematic exercise, such as horseback riding, etc., not infrequently prescribed by their medical adviser who lives thousands of miles distant. It has been my lot to meet in Colorado loyal patients whose lives have been sacrificed by over-exercise in their attempts to take as much exercise as they had been requested to do by their physicians before they left home. The advice, often given by physicians, unacquainted with the climate of Colorado, on sending

patients there, is: "Go to Colorado; live in the open air as much as possible; live on horseback all day long; herd sheep or drive (punch) cattle." The first part of this advice—"live in the open air as much as possible"—is excellent, but the remainder is simply murderous for nine out of every ten consumptive patients who go to Colorado.

In this paper I have endeavored to enumerate most of the nervous and vascular disturbances from which many invalids, who seek Colorado as a health-resort, and over-exercise on first going there, will suffer. I might add to the vascular disturbances, pulmonary hemorrhage, only, however, to be feared when exercise is considerable. On the other hand, for nine out of every ten invalids who go to Colorado and live as quietly as their cases demand, the process of acclimatization will be easy and unattended by any serious inconvenience. The other one-tenth, either on account of excessive nervousness, irritable or weak heart, or some other unavoidable cause, will experience some difficulty on first going there, no matter how quietly they live, but the disturbance is incomparably less by living a quiet life. Of course, in this estimate, we must exclude certain cases of far-advanced consumption with little breathing room, which should never go to a high altitude. Despite every effort to the contrary, there are a few nervous and consumptive patients who can never live comfortably in a high altitude. I suspect that in these cases the heart is at fault. Some persons go to Colorado, and while living a comparatively quiet life, are so uncomfortable as to have to seek a lower altitude, but in a few months return and live there without much inconvenience.

I have known persons, for whom a lower altitude was out of the question, become so nervous and miserable in Colorado that their lives were a burden to themselves and friends, go to bed and live absolutely quiet for a few weeks, then become less nervous and be able to live there in comfort and take a moderate amount of exercise. In my opinion, the best management for all persons who become nervous, irritable, sleepless, etc., in Colorado on account of the climate, is a residence at a low altitude for a few months. We must remember that many persons become exceedingly nervous at sea-level, so that a great many

cases of nervousness arise in Colorado with which the climate of itself has little or nothing to do. Some cases of nervousness arising at sea-level are benefited by going to Colorado, provided exercise be avoided at first.

Most cases of pure nervousness arising in Colorado are more or less benefited on seeking a lower altitude.

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